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(continued on next page)

(54) Abstract Title: **Footwear liners**

- (57) A method of simultaneously shaping and securely bonding footwear components in three dimensions utilising an elastic membrane with controlled heat and pressure. In particular the present invention relates to footwear liners commonly used in conjunction with outer articles of footwear such as boots and shoes and the like, a method of constructing such liners with an over moulded integral insole and sole combined is disclosed.

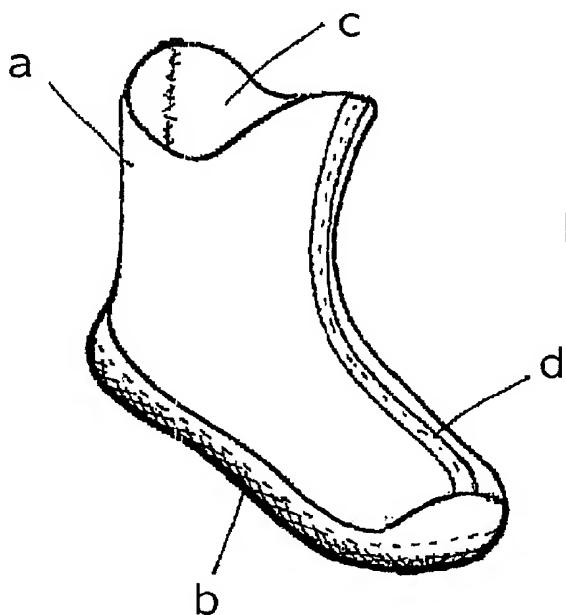


FIG.1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date but within the period prescribed by Rule 25(1) of the Patents Rules 1995.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

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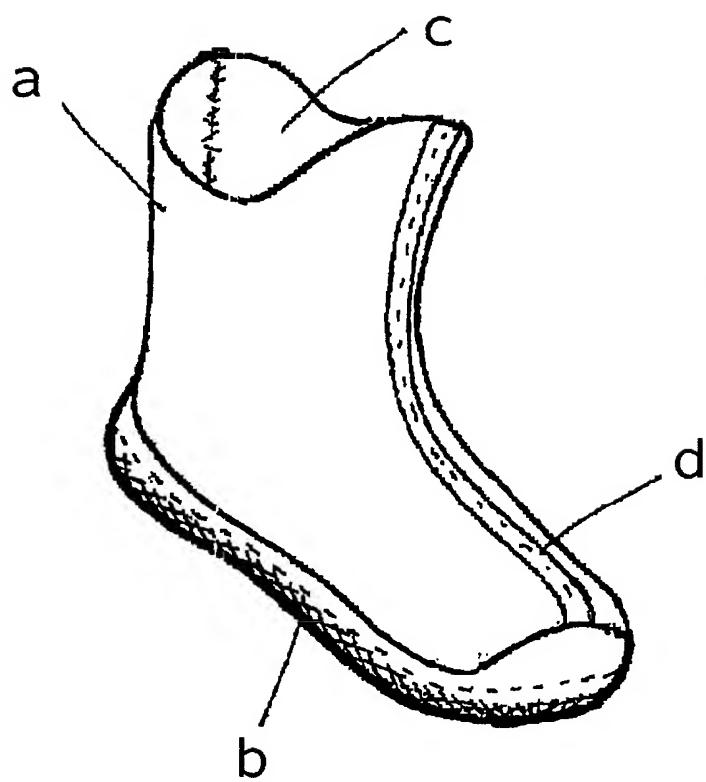
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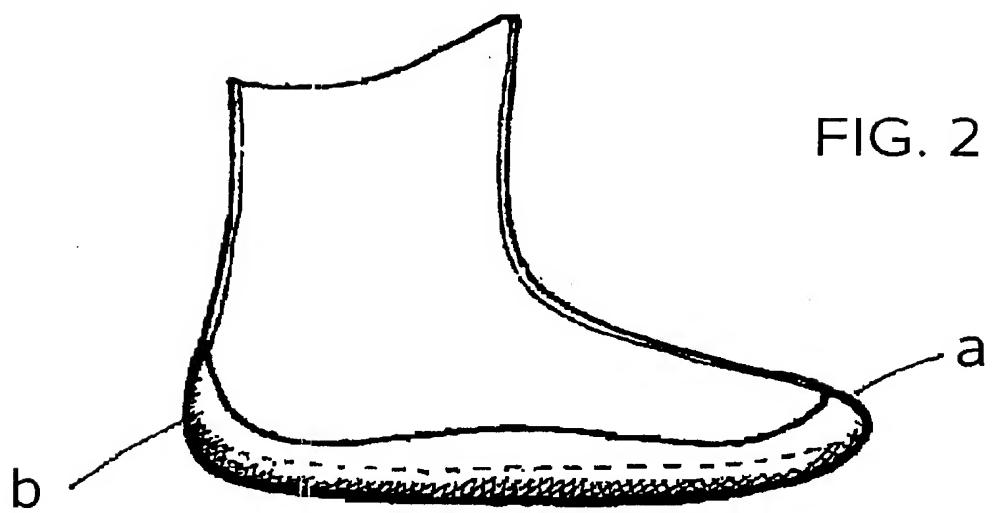
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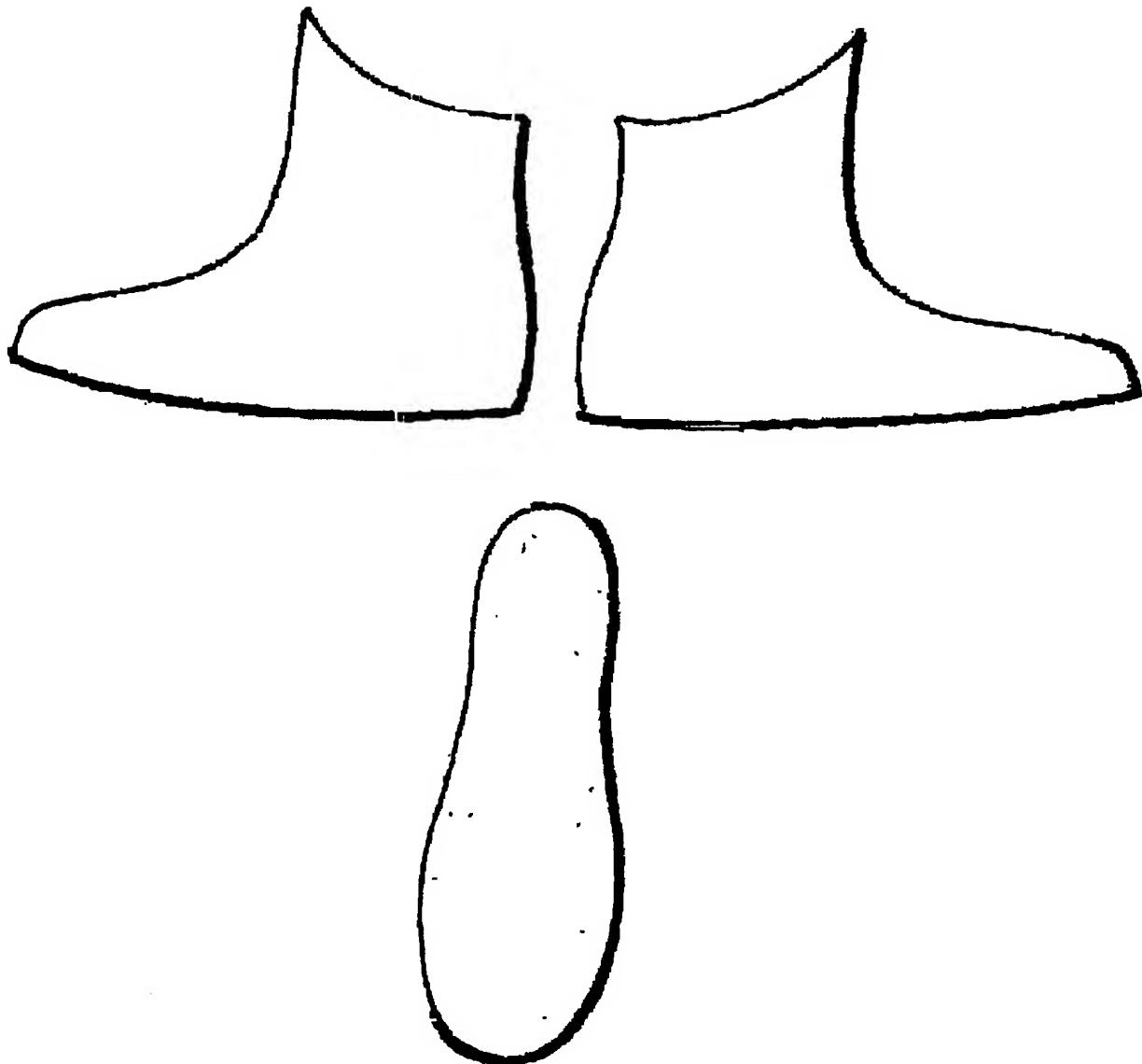


FIG. 3

Fig.
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Fig.
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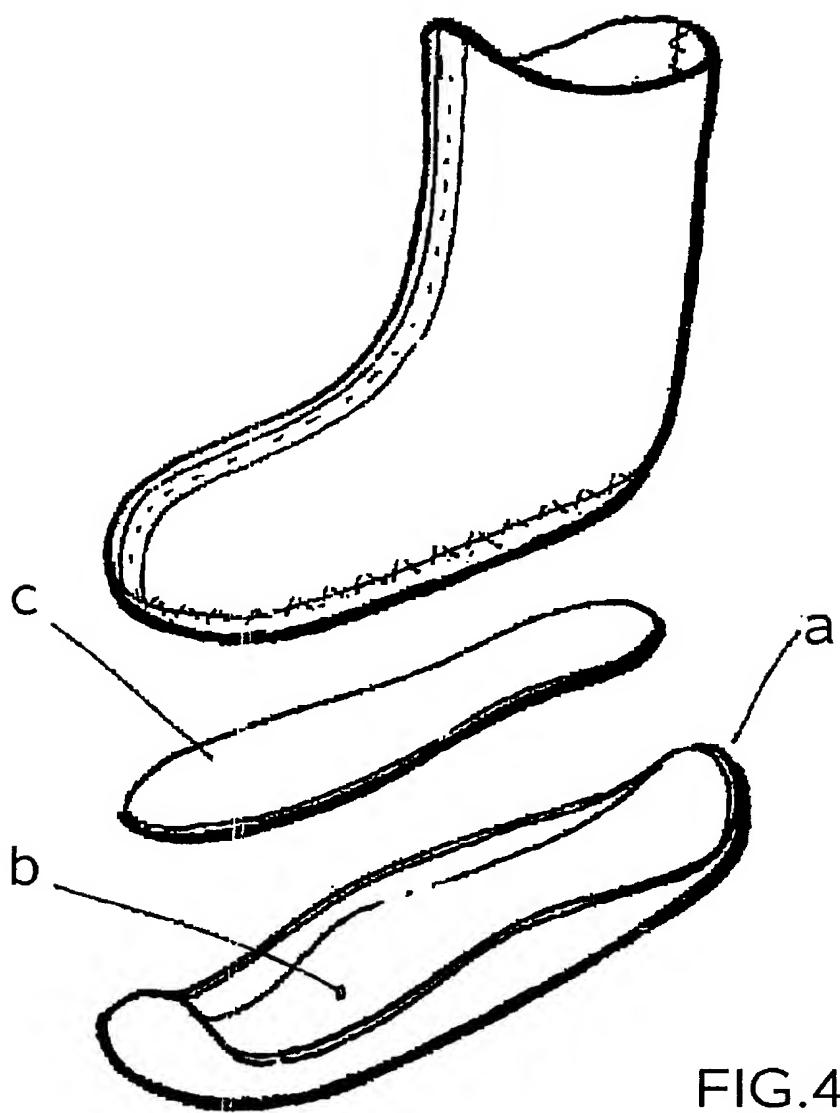


FIG.4

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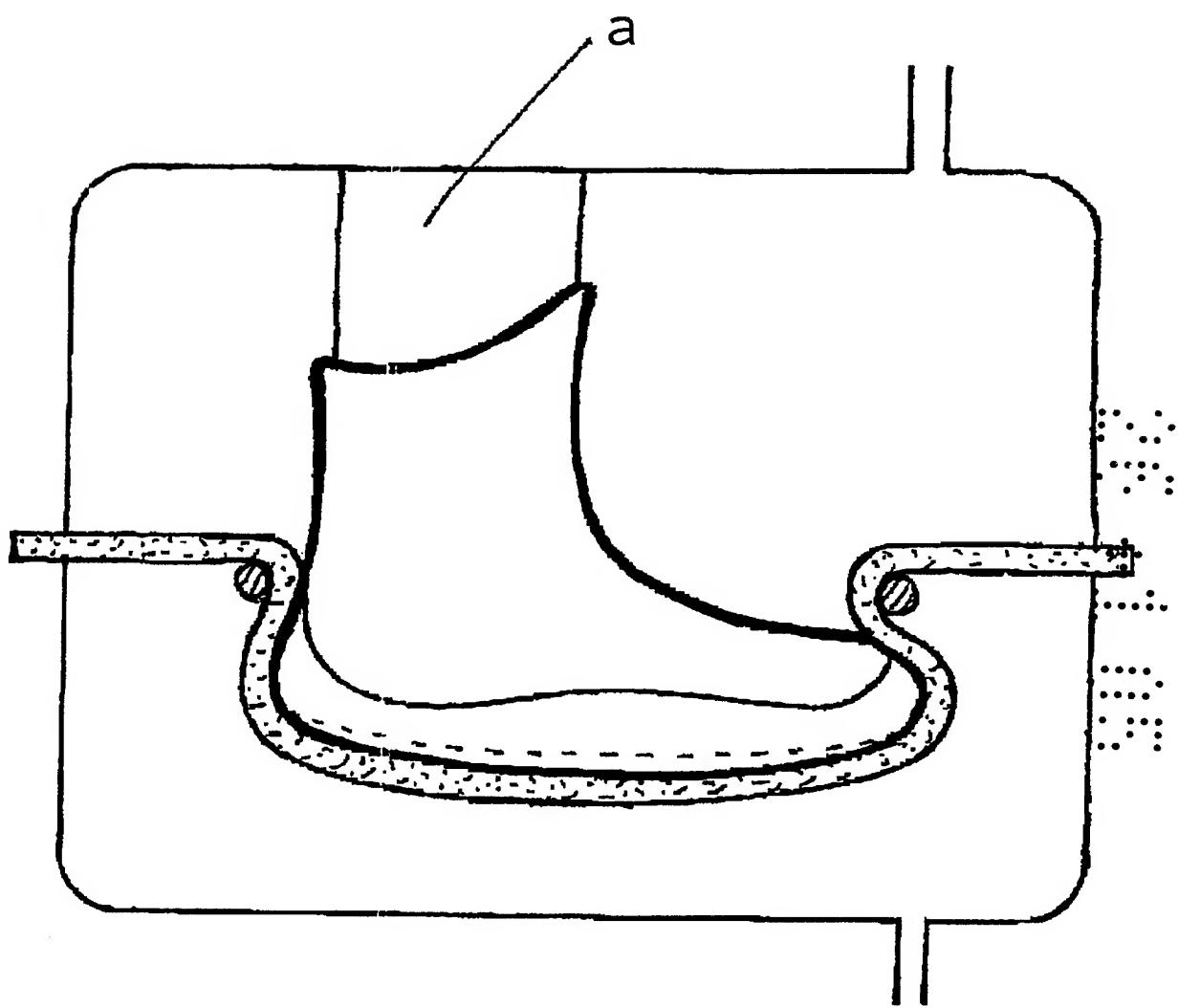
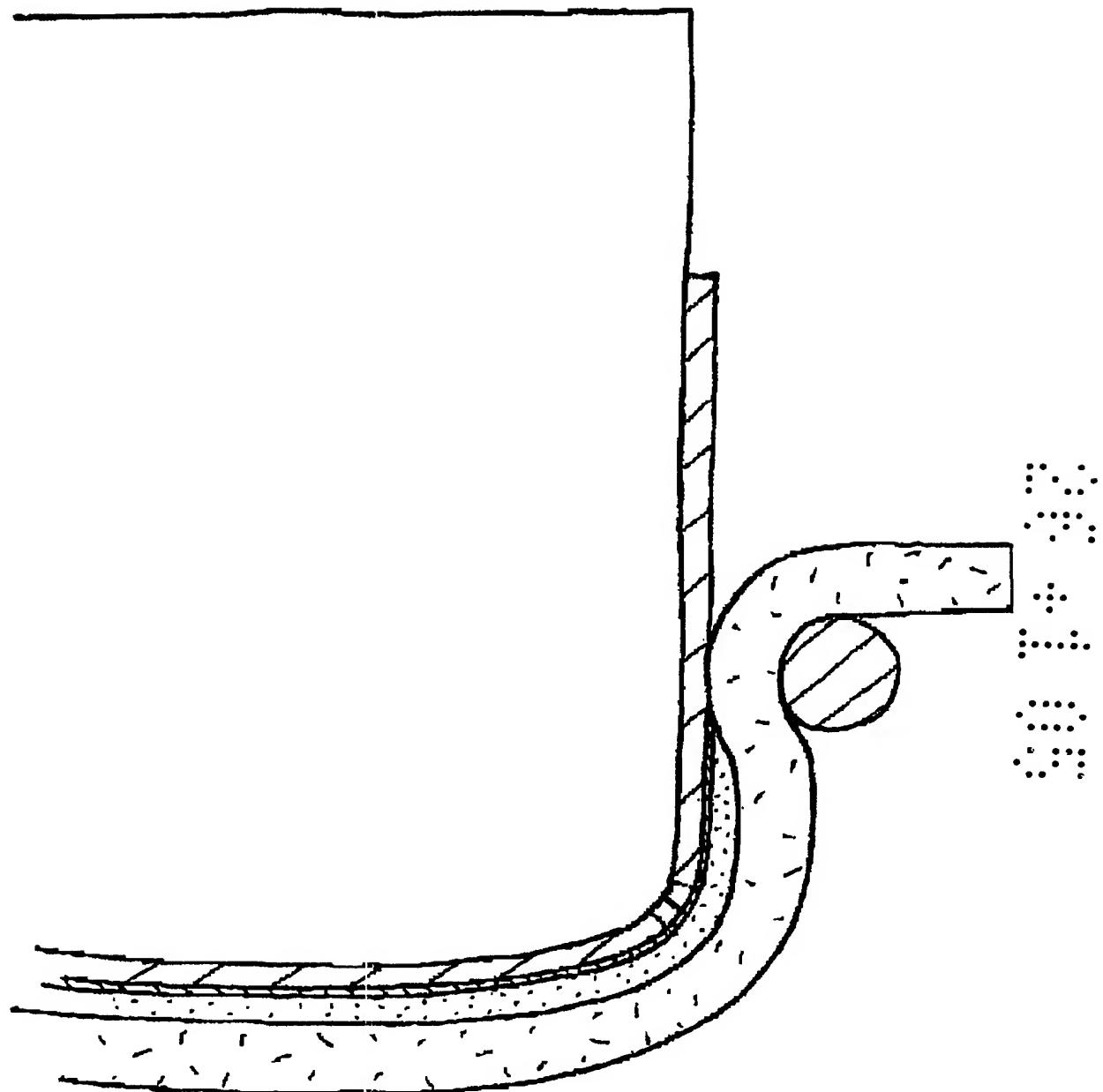


FIG.5

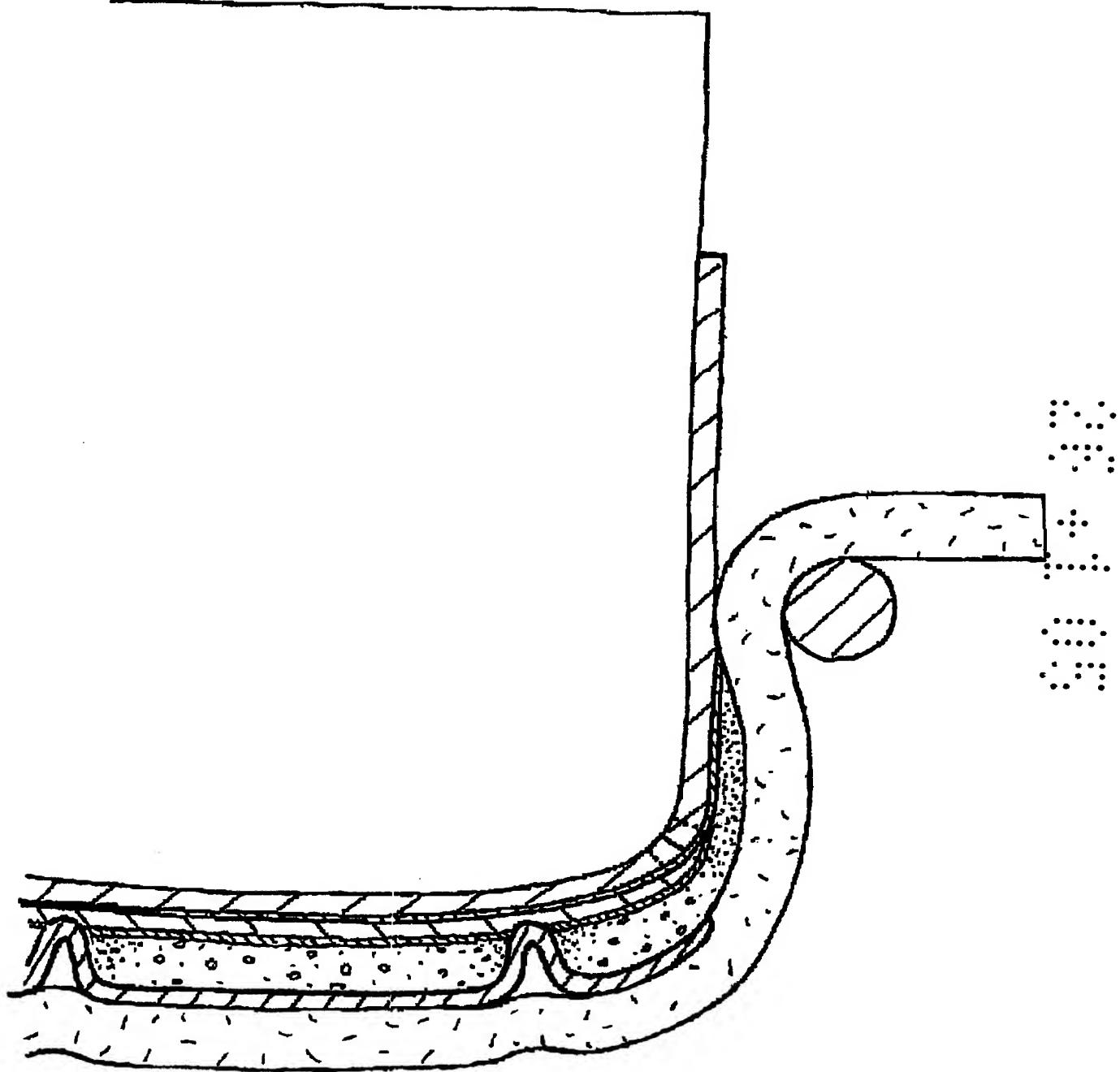
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FIG. 6



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FIG.7



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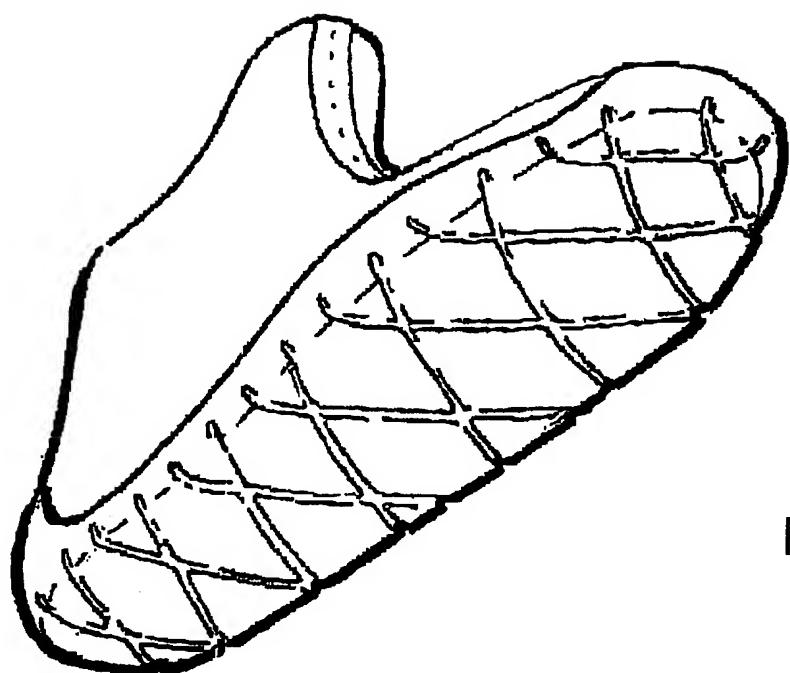


FIG.8

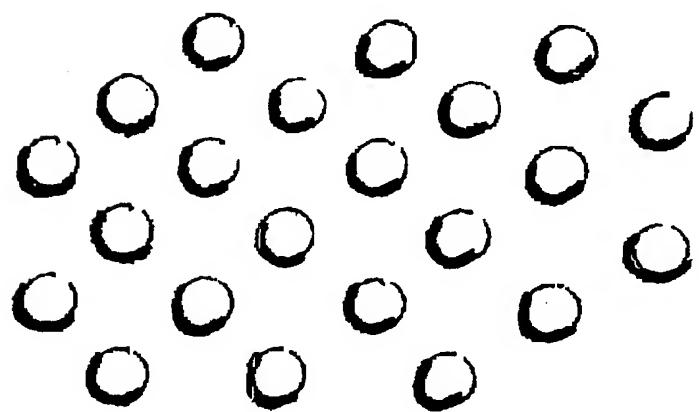
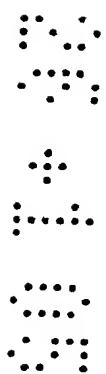


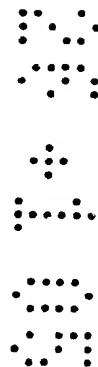
FIG.9

FOOTWEAR LINERS AND METHOD FOR MAKING THE SAME

The present invention relates to detachable footwear liners commonly used in conjunction with outer articles of footwear such as boots and shoes and the like

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- Articles of footwear such as boots and shoes are typically constructed from a plurality of components the components are assembled using techniques such as stitching, bonding and riveting. Footwear is typically composed of an upper part, which provides access via an opening for a foot and a lower part the sole, together they create an internal volume to accommodate a foot. Such articles of footwear have a major outer surface and a major inner surface. Upon the said interior surface of the footwear there is commonly affixed a permanent lining material. The composition of such linings can be specified to enhance performance and impart properties such as strength, stiffness, ventilation, insulation, bacterial control, permeability and comfort to the footwear.
- 10 Typically articles of footwear with affixed linings are specified and constructed for particular environments and uses. As a simple example, the specification of a lining material for a walking boot to be used in a hot environment would be a thinner and lighter material than that used for a similar boot to be used in cold environments. Therefore a boot intended for use in a desert climate would not perform well in an arctic climate and vice versa.
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- 20



By way of an improved method of construction some articles of footwear are fabricated with a detachable sock-like internal liner commonly referred to as a 'bootie'. The advantages of such a dual inner and outer construction are numerous and include the ability to adapt the properties and performance of the footwear article as a whole by removing and replacing one bootie with another bootie which has been manufactured to a different specification than the prior. Additionally such articles of footwear can be dried (if wet) and cleaned more efficiently when the booties are removed from within the outer boot or shoe.

It is known from prior art that various embodiments of bootie's exist the documents generally disclose novel features, constructions and specific applications for articles of footwear that utilise an inner removable liner such as a bootie.

5 Prior art of particular relevance; US4599810 to Guillaume, WO02080720 to Sheets & Finney, US5526584 to Bleimofer & Danielax, WO9619127 to Herbert, EP0976337 to Labarre. These documents are applicable to booties but generally do not disclose novel methods of manufacturing the said booties.

10 Prior art; ES2024806 to Jellici, US4454619 to Bichet, US4761845 to Funck, EP0730833 to Delique, FR2614768 to Lassade. These documents generally disclose devices for holding, pressing and bonding articles of footwear during their construction primarily they employ an elastic membrane to exert pressure upon the components during processing.

15 According to the present invention there is described a method of constructing sock-like footwear inner liners commonly used in conjunction with outer articles of footwear, such as boots, shoes. More specifically the invention discloses a method to over mould an integral comfort padding with a durable outer surface to the bottom and sides of the liner. Where such padding is three-dimensionally formed and bonded to the liner in a single operation using an elastic membrane to exert controlled pressure and transfer controlled heat to the padding and liner simultaneously. During the process the padding is selectively densified in specific locations and formed to a predetermined shape so that its outer surface can intimately fit inside other articles of footwear if so required.

Brief description of the drawings

30 Figure 1 shows in perspective a bootie with an over moulded sole.

Figure 2 shows a side view of a bootie with an over moulded sole.

Figure 3 shows a plan view of the major fabric components prior to fabrication used to assemble the bootie.

- 5 Figure 4 shows a perspective view of an assembled bootie and insert component and perform for the moulded sole prior to assembly with the bootie.

Figure 5 shows a schematic drawing of the device and process.

- 10 Figure 6 shows a partial section of the bootie on a former and being compressed by the membrane shows method without pressure masking.

Figure 7 shows a partial section of the bootie on a former being compressed by the membrane method with pressure masking.

- 15 Figure 8 shows a perspective for an assembled bootie with mesh a mesh pattern in three-dimensional relief on the over-moulded sole.

Figure 9 shows a plan view for a possible optional three-dimensional relief.

- 20

Here within is described in detail an article of footwear and a method of manufacturing the same with reference to the accompanying drawings.

- 25 Whereby the article of footwear is configured to cover the lower leg and foot of the wearer and is composed of an upper portion (Fig 1 a) where there is located an orifice (Fig 1 c) through which a foot can be inserted and a lower portion the sole (Fig 1 b), so when considered as a whole the two portions create an envelope with an interior volume. Generally, the envelope is configured as an angled tube with an open end and
 30 a closed end where the closed end is formed to accommodate a wearer's toes (Fig 2 a) and the apex of the angle is formed to accommodate a wearer's heel (Fig 2 b). The orifice is formed to accommodate a wearer's ankle or lower leg area about the calf. The

- tubes opening many be configured with one or more longitudinal cuts extending partly towards the closed end of the tube to aid the entry of a foot and may also employ a method of constricting the opening such as can be achieved with elastic or cord when affixed around the circumference of the opening. This may also be achieved by
- 5 affixing elastic or cord to both sides of one or more of the longitudinal cuts that aid the entry of a foot, other suitable fastening devices may be employed such as hook and loop fastenings (Velcro, a well known trade name) press studs, zip fasteners and buttons. The envelope may be constructed from a single or plurality of component parts that are affixed substantially edge to edge by stitching, bonding by heat, adhesive,
- 10 radio frequency vibrations, ultrasonic frequency vibrations, laser, taping and riveting and by any other suitable means. In the preferred embodiment there is two sides and one bottom components (Fig 3) joined by stitching at their peripheries and the seams taped over to make the joints water tight (Fig 1 d). In an alternative embodiment the envelope may be constructed from a tubular monocoque structure such as formed when
- 15 knitting a sock. In a preferred embodiment of the invention the bootie envelope is manufactured using textile materials laminated into composite structures wherein knitted, woven and non-woven, materials are bonded in layers with polymer films to produce hybrid fabrics with specific properties.
- 20 Such a laminate structure would comprise of a surface layer and a middle layer combined with an outer polymer film. In an alternative embodiment a simpler structure would be comprised of two layers where a polymer film is laminated to one side of a textile. Commonly the polymer film is itself a multi-layered structure and between the layers at the interfaces of the materials adhesive layers are often employed
- 25 to bond the laminations together.

In a preferred embodiment the polymer film is engineered to be impermeable to water and permeable to water vapour. Therefore allowing a wearer's foot to stay dry in wet conditions and yet still allowing the bootie envelope to breath and transport water vapour away from the foot.

The booties over-moulded padding is comprised of a thermoplastic polymer pre-form (Fig 4 a), this is a sheet material of between 0.1 and 10 millimetres thickness formed to the approximate shape of the booties sole and is pre-coated with a heat activated adhesive on its inner surface (Fig 4 b, Fig). Preferably this is composed of a durable 5 polymer such as EVA, PE-EVA copolymers, PU's, TPE's, TPR's or other elastomers with similar properties. The pre-form can be a solid or a cellular material however it is preferred that the pre-form material is composed of a cellular closed cell structure. Between the outer pre-form and the sole of the bootie envelope additional spacer materials and structures can be positioned such as felts, open or closed cell materials 10 waffle structures, gels, bladders and the like (Fig 4 c).

In a preferred embodiment a method to securely affix the pre-form and any additional spacer materials is described in detail.

15 The assembled bootie envelope is securely placed onto a close fitting foot shaped mandrel (Fig 5 a) that can be heated and cooled in a controlled manner. In an optional embodiment of the invention at this stage a heat activated adhesive is applied to the sole of the bootie envelope and/or a pre-coated spacer components are placed in repeatable fashion onto the bootie envelopes sole.

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In the preferred embodiment of the invention the pre-form is positioned onto and over the booties envelope sole with the pre-coated adhesive in close proximity to the envelopes sole.

25 To effect a selectively densified over-moulded sole a substantially planar but three-dimensional semi-rigid support is then positioned onto the outer surface of the pre-form this serves to selectively reduce or mask the pressure exerted upon the pre-form in predetermined areas and in a repeatable manner. This can easily be achieved with mesh like materials or in an optional embodiment of the invention the elastic membrane used to exert pressure during the bonding process has patterned areas 30 with higher and lower rigidity and therefore also areas with higher and lower elasticity.

This can be achieved by texturing the surface of the membrane in contact with the pre-form with a three-dimensional relief.

In a preferred embodiment of the invention the assembly comprising of the mandrel, bootie envelope, adhesives, spacer materials, pre-form and the pressure mask is placed inside a vessel or chamber and a heat resistant elastic membrane such as silicone is placed over the assembly and then sealed by the outer edge of the chamber. A pressure is exerted onto the assembly by the membrane and the assembly of components is supported by the mandrel. The pressure is applied by creating an unequal pressure on one side of the membrane compared to the other this is achieved by means of fluids or gases supplied into the chamber or evacuated from a chamber.

While the assembly is being compressed by the membrane the mandrel and the membrane are heated (between 80°C and 200°C) and then cooled to a temperature where the pre-form materials are stable. During the pad is securely bonded to the sole of the liner and extends around the sides, heel and over the toe area. To aid the forming process particularly around the toe and heel areas a tourniquet device helps to constrict the membrane in specific locations of the bootie. The method of masking the pressure improves the fit of the bootie inside an outer article of footwear by reducing the thickness of the over-moulding locally at the sides and also improves comfort by allowing the cell structure to remain and the pre-form is therefore substantially thicker under the foot than at the sides.

Claims

1. A footwear liner for use in boots and shoes and the like, comprising a sock-like liner having a comfort padding with a durable outer surface moulded to the bottom and sides of the sock-like liner.
5
2. A footwear liner according to claim 1 wherein the padding is formed three dimensionally and bonded to the liner.
- 10 3. A footwear liner according to claim 1 or claim 2 where the padding comprises selectively densified locations.
- 15 4. A footwear liner according to any preceding claim when the padding is formed to a pre-determined shape so that its outer surface can intimately fit inside other articles of footwear.
- 20 5. A footwear liner according to any preceding claim wherein the sock-like liner comprises a tube having an orifice to accommodate a wearer's ankle or lower leg, wherein the tube is configured with one or more longitudinal cuts to aid the entry of a foot.
- 25 6. The footwear liner according to any preceding claim wherein the sock-like liner comprises a tube having an orifice for accommodating a wearer's ankles or lower leg wherein the tube comprises means for constricting the orifice such as an elastic, cord, hook and loop fastenings, press stubs, zip fasteners and/or buttons.
- 30 7. A footwear liner according to any preceding claim wherein the sock-like liner comprises an envelope constructed from a single or plurality of components affixed substantially edge to edge by stitching, bonding by heat, adhesive, radio frequency vibrations, ultrasonic frequency vibrations, laser, taping and/or riveting.

8. A footwear liner according to claim 7 comprising an envelope having two sides and a bottom component joined by stitching at the peripheries and having the seams taped over to make the joints watertight.
- 5 9. A footwear liner according to claim 7 or 8 comprising an envelope constructed from a tubular monocoque structure.
10. A footwear liner according to any of claims 7, 8 or 9 wherein the envelope comprises textile materials laminated into composite structures wherein knitted, woven and non-woven materials are bonded in layers with polymer film to produce hybrid fabrics with synthetic properties.
11. A footwear liner according to claim 10 wherein the laminate structure comprises a surface layer and a middle layer combined with an outer polymer film.
- 15 12. A footwear liner according to claim 11 wherein the laminate structure comprises two layers in which a polymer film is laminated to one side of a textile.
13. A footwear liner according to claim 11 or 12 wherein the polymer film is a multi layered structure and between the layers at the interfaces of the materials adhesive layers are employed to bond the laminations together.
- 20 14. A footwear liner according to claim 11, 12 or 13 wherein the polymer film is impermeable to water and permeable to water vapour.
- 25 15. A footwear liner according to any preceding claim wherein the padding comprises a thermoplastic polymer pre-form preferably of a sheet material of between 0.1 and 10 millimetres thickness.
- 30 16. A footwear liner according to claim 15 wherein the thermoplastic polymer pre-form comprises a durable polymer such as EVA, PE-EVA copolymers, PU's, TPE's or TPR's.

17. A footwear liner according to claim 15 or 16 wherein the thermoplastic polymer pre-form is a solid or cellular material and preferably is composed of a cellular closed cell structure.

5 18. A footwear liner according to any preceding claim wherein spacer materials and structures are provided between the padding and the sole of the sock-like liner which spacer materials and structures can comprise felts, open or closed cell materials, waffle structures, gels, and/or bladders.

10 19. A method of constructing a footwear liner for footwear such as boots and shoes, comprising the steps of moulding an integral comfort padding with a durable outer surface to the bottom and sides of a sock-like liner.

15 20. A method according to claim 19 wherein the padding is three dimensionally formed and bonded to the sock-like liner in a single operation using an elastic membrane to exert controlled pressure and transfer controlled heat to the padding and sock-like liner simultaneously.

20 21. A method according to 19 or 20 comprising the step of selectively densifying specific locations of the padding during the bonding process.

22. A method according to claim 19, 20 or 21 wherein the padding is formed to a pre-determined shape prior to bonding so that its outer surface can intimately fit inside other articles of footwear.

25 23. A method according to any claims 19 to 22 wherein the padding comprises a thermoplastic polymer pre-form preferably made of sheet material opting 0.1 and 10 millimetres thickness and preferably formed to the approximate shape of the liner's sole.

30 24. A method according to claim 23 when the padding is pre-coated with a heat activated adhesive on the inner surface.

25. A method according to any of claims 19 to 24 comprising the step of placing the sock-like liner (envelope) securely in place on a close fitting shoe shaped mandrel to be heated and cooled in a controlled manner.

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26. A method according to any of claims 19 to 25 comprising the step of applying a heat activated adhesive to the sole of the sock-like liner (envelope) and/or placing a pre-coated spacer component onto the sock-like liner (envelope) sole.

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27. A method according to claim 26 wherein the padding is positioned onto the envelope sole with the pre-coated adhesive in close proximity to the envelope's sole.

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28. A method according to any of claims 19 to 27 comprising a step of effecting selected densification of an overmould sole by positioning a substantially planer, but preferable three dimensional, semi rigid support onto the outer surface of the pre-formed padding preferably to serve selectively to reduce or mask the pressure exerted upon the pre-formed padding in predetermined areas and in a repeatable manner.

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29. A method according to claim 28 wherein the semi rigid support comprises mess like materials.

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30. A method according to any of claims 19 to 29 wherein an elastic membrane is used to exert pressure during the bonding process and preferably patterned areas with higher and lower rigidity are also formed.

31. A method according to any of claims 19 to 30 wherein the liner is heated to between 80°C and 200°C.

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32. Apparatus for manufacturing a liner for use in boots and shoes, the apparatus comprising a mandrel for supporting a liner and pre-assembled components therefore, a membrane for exerting a pressure on the liner when mounted on the mandrel in use and

means for exerting pressure on the membrane which pressure is unequally applied to one side of the membrane, preferably achieved by means of fluids or gasses supplied into the chamber or evacuated from a chamber.

- 5 33. Apparatus according to claim 32 preferably comprising means for heating the liner when mounted on the mandrel, to between 80°C and 200°C.



Application No: GB0325211.1

Examiner: Mr Colin Thompson

Claims searched: 1-31

Date of search: 17 March 2005

Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
X	1,2,4,7,15,16, 19,22,33	US 5855079 A (Herbert) See Fig 1
X	1,2,4,7,8,19,22	US 5499459 A (Tomaro) See whole document
X	1,2,4,19,20,22	US 6311412 B1 (Grilliot) See Figs 5 & 6
X	1,4,6,7,19,22	WO 01/33987 A1 (Benetton Group SpA)
X	1,4,7,19,22	US 5253434 A (Curley) See whole document
X	1,4,19,22	US 6305101 B2 (Chemello) See whole document

Categories:

X Document indicating lack of novelty or inventive step	A Document indicating technological background and/or state of the art.
Y Document indicating lack of inventive step if combined with one or more other documents of same category.	P Document published on or after the declared priority date but before the filing date of this invention.
& Member of the same patent family	E Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC^X :

A3B

Worldwide search of patent documents classified in the following areas of the IPC⁰⁷

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The following online and other databases have been used in the preparation of this search report

WPI, EPODOC